

CHAPTER

15

Education and Research

contents

Outline 1066

- Fundamentals of Education
- Learning Domains
- Instructors
- Students
- Professional Competency
- Introduction to Research Methods
- Research Methods
- Measures and Sampling
- Planning the Study
- Introduction to Statistical Terms
- Writing a Journal Article

Review Questions 1078

Answers & Rationales 1081

References 1085

I. FUNDAMENTALS OF EDUCATION

A. Components of Education

1. **Curriculum** is determined by the **body of knowledge** of the profession.
2. **Competencies** are the **skills** that must be mastered by students to become an entry-level clinical laboratory scientist.
3. **Goals** are general statements of **learning outcomes** that typically apply to a whole course or curriculum.
4. **Objectives** are **measurable** and **observable behaviors** that will enable students to master entry-level competencies.
5. **Instruction** is the **process of passing knowledge and skills** to students. This can include lecture, reading, demonstration, the Internet, and group projects. It includes design of practice to develop psychomotor skills and attitudes in the affective domain.
6. **Tests** measure the amount of **knowledge** students have **learned**. Tests should be **objective measures** of learning.
7. **Evaluation** measures **cognitive, psychomotor, and behavioral learning**. It documents how well students master entry-level competencies.

B. Competency-Based Education (CBE)

1. **Definition:** Program curriculum is based on entry-level competencies as determined by the profession.
2. The competencies are set by the **National Accrediting Agency for Clinical Laboratory Sciences (NAACLS)** in the *Standards of Accredited Educational Programs*. These competencies are supported by the **certification examination content guidelines** of the **American Society for Clinical Pathology Board of Registry (ASCP BOR)** and the **National Credentialing Agency for Laboratory Personnel (NCA)**.
3. **Objectives** are **action statements** that reflect the **skill (psychomotor domain)**, the **behavior (affective domain)**, and the **knowledge (cognitive domain)** to be mastered by a student. The objectives must be **measurable** so student progress toward mastery of the objectives can be assessed.
 - a. Each objective must contain:
 - 1) The **doer** (A = Audience)
 - 2) The **activity** (B = Behavior, the action verb; success is measurable)
 - 3) The **specified conditions** (C = Conditions, circumstances)
 - 4) The **standard** (D = Degree that implies mastery)
 - 5) For example, the *student* (doer) must *classify* the bacteria (the activity) in *5 minutes* (condition) with *100% accuracy* (the standard).
 - b. **Objectives benefit students by:**
 - 1) Clearly stating **expectations** of students
 - 2) Helping students **capture relevant subject matter**
 - 3) Providing students with **self-direction**
 - 4) Establishing a **lifelong learning** process for students

c. **Objectives benefit instructors by:**

- 1) Clearly defining **expectations** of students
- 2) Identifying **important subject matter**
- 3) Establishing **criteria** for testable material
- 4) Holding instructors **accountable**
- 5) Helping instructors **plan** course content, lectures, and laboratory experiences

II. LEARNING DOMAINS

A. Cognitive Domain

1. Consists of progressive levels of difficulty
 - a. **Knowledge:** Recall, facts
 - b. **Comprehension:** Linking to what you already know
 - c. **Application:** Relating new knowledge to a new situation
 - d. **Analysis:** Breaking down a situation into its components and determining the interrelation of its parts
 - e. **Synthesis:** Taking separate components and bringing them together to produce a meaningful new product
 - f. **Evaluation:** Judging the value of information (such as research articles or data) for a specific purpose

B. Affective Domain

1. Consists of progressive levels of commitment, depth, and sophistication
 - a. **Receiving:** How students listen; their attitude toward constructive criticism and directions
 - b. **Responding:** How students reply and demonstrate new behaviors as a result of experience
 - c. **Valuing:** Students exhibit involvement and a commitment to learning opportunities, constructive criticism, and directions.
 - d. **Organization:** How students integrate a new value into their current set of values, and rank the new value among the current set
 - e. **Characterization:** The inherent personality manifested in behavior that is consistent with the new set of values

C. Psychomotor Domain

1. Consists of progressive levels of complexity
 - a. **Observation:** Watches a procedure or assay being performed
 - b. **Preparation:** Organizes work space to perform an assay or procedure
 - c. **Manipulation:** Completes the assay or procedure
 - d. **Coordination:** Performs many tasks in an efficient manner; multitasks
 - e. **Adaptation:** Transfers old skills when performing a new procedure
 - f. **Origination:** Develops new manual dexterity to perform tests more easily or efficiently

III. INSTRUCTORS

A. Roles of the Instructor

1. **Expert:** Must be knowledgeable about the subject she/he is teaching; must be capable of using resources.
2. **Authority:** Instructors are given formal authority over students.
 - a. Formal authority includes developing course syllabi, policies and procedures, grading structure, test structure, and relevant cognitive, behavioral, and psychomotor objectives.
 - b. Instructors need to be familiar with the institution's policy on cheating and need to follow established guidelines. Ignoring the problem does not help the student and damages the morale of other students who may be aware of the situation.
 - c. Instructors must oversee that students develop entry-level competencies.
3. **Facilitator:** Organize and present knowledge to students in an orderly, understandable manner
 - a. The instructor must take into account different student learning styles and different student learning rates.
 - b. The instructor is responsible for helping students to apply what they have learned.
4. **Compliance manager:** Responsible for ensuring students follow the policies and rules of the program and institution
5. **Responsibilities:**
 - a. Compliance with OSHA safety regulations
 - b. Be prepared for class
 - c. Provide appropriate turnaround time for assignments, grades, and evaluations

B. Teaching Methods

1. **Lesson plan** is an outline of what should be accomplished using:
 - a. Cognitive, affective, and psychomotor objectives
 - b. Lecture notes and/or handouts
 - c. Electronic presentations disseminate information to large groups, can incorporate multimedia to appeal to different learning styles; time-consuming to create, require special equipment to present
 - d. Overhead transparencies are easy to prepare, but typically contain too much information
 - e. Kodachrome slides can project special images, such as parasites or blood cells; require special equipment and a darkened room to present
 - f. Demonstrations, etc.
 - g. Internet resources
2. **Lecture** is a setting in which an expert talks to a group of people about a particular topic.
 - a. Good for disseminating large amounts of information to many students simultaneously

- b. Popular format
 - c. Allows little opportunity for discussion
- 3. **Cooperative learning**
 - a. Small group learning topics
 - b. Groups use all members as resources, cooperating in a friendly environment to learn.
- 4. **Problem-based learning (PBL)**
 - a. Presentation of a problem/scenario to students
 - b. Students work together to find the solution
- 5. **Computer-assisted learning** provides software programs for students to use in learning and reviewing topics.
- 6. **Role play**
 - a. Students act out situations
 - b. Provides nonthreatening learning environment
 - c. Identify solutions to difficult/challenging scenarios
- 7. **Distance education** utilizes nontraditional delivery methods to facilitate students' learning.
 - a. Traditional lectures delivered at specific outreach sites away from a higher learning institution.
 - 1) Via the Internet for online courses
 - 2) Via video conferencing equipment

C. Assessment

- 1. **Definition:** Means of determining how well students understand the subject matter presented to them
- 2. **Types of evaluation tools**
 - a. **Checklist:** Often used in conjunction with a practical examination to assess competency pertaining to a particular task; lists components within a particular task and each component is checked for completion
 - b. **Pretest:** Test given to students to determine what students **already know** about a subject
 - c. **Posttest:** Test given to students to determine what they **have learned**; pretest score compared with posttest score to assess learning
 - d. **Norm-referenced test:** A test in which the students are **evaluated** based upon their performance **in relation to** that of their **peers**
 - e. **Criterion-referenced test:** A test in which the students are **evaluated** based upon **actual mastery** of the material; **criteria** for scoring are **established prior** to administration of the test (e.g., summative test such as a national certification examination)
 - f. **Diagnostic examination:** Used to assess the presence/extent of disability and need for accommodations
- 3. **Test attributes**
 - a. **Reliability:** Refers to how stable and consistent a test is from year to year

- 1) Consistency relates to reviewing the subject matter annually and editing the test appropriately.
- 2) Adequate test questions
- 3) Objective test questions
- b. **Validity:** When a test asks questions about specific information
- c. **Objectivity:** Questions that **relate back to stated objectives**, fairness, adequate time to complete, good format (sufficient space to answer questions)
4. **Structure and assessment of test questions**
 - a. Three levels: **Level I** (Recall), **Level II** (Interpretation), and **Level III** (Problem solving)
 - 1) **Level I—Recall:** This is the simplest question because it asks the student to recite information.
 - 2) **Level II—Interpretation:** The student is asked to use material learned to tell something about a process, test, or principle.
 - 3) **Level III—Problem solving:** The student is presented with a problem and asked a specific question related to that problem.
 - b. **Assessing test question responses using rubrics**
 - 1) **Level I questions** are typically objective (i.e., multiple choice, true/false, matching, short answer). These can be challenging to create but are easy to grade.
 - 2) **Level II questions** may be objective. Other formats include short answer or essay.
 - 3) **Level III questions** may also be objective, but typically are not. They can be easy to create (i.e., short answer or essay questions to demonstrate the ability to solve/resolve a problem). However, these questions are challenging to grade. A **rubric** is a **list of criteria or expectations** established and utilized **to assess a student's mastery** of a written assignment or problem. The rubric should be scaled with varying levels of achievement based upon the expectations of the instructor, and it should be presented to the student prior to completion of the assignment whenever possible.

IV. STUDENTS

A. Learners/Students

1. **Definition:** Students are contracted customers who take classes to earn a degree, diploma, or certification, or to learn specific information. Graduates of a program are products of the educational process.
2. **Responsibilities:**
 - a. Know degree requirements from the school
 - b. Attend all classes and be on time
 - c. Maintain academic honesty

- d. Maintain a professional demeanor
- e. Adhere to institution, department, and class rules
- f. Notify instructor as soon as possible if absent, tardy from class, or if something prevents completion of an assignment
- g. Respect the role of the instructor and the right of fellow students to a productive learning environment

B. Rights

- 1. Right to a quality education
- 2. Right to fair assessment in a class
- 3. Right to respect from the instructor
- 4. Right to ask questions
- 5. Right to receive extra help

V. PROFESSIONAL COMPETENCY

A. Clinical Laboratory Science Educational and Professional Organizations

- 1. **NAACLS** (National Accrediting Agency for Clinical Laboratory Sciences) is an organization that **accredits** medical technology/clinical laboratory scientist and medical technician/clinical laboratory technician **educational programs**.
 - a. Develops the *Standards of Accredited Educational Programs*
 - b. Monitors institutional compliance with the *Standards*
 - c. Requires affiliation agreements between academic institutions and clinical education sites to ensure the educational experience
- 2. **ASCP BOR** (ASCP Board of Registry) is a **credentialing agency** that develops and administers an examination to certify medical technologists (MTs) and medical laboratory technicians (MLTs).
- 3. **NCA** (National Credentialing Agency for Laboratory Personnel) is a **credentialing agency** that develops and administers certification examinations for clinical laboratory scientists (CLSs) and clinical laboratory technicians (CLTs).
- 4. **ASCLS** (American Society for Clinical Laboratory Science) is a **professional organization** for clinical laboratory science practitioners that promotes all aspects of the profession and to which an individual can hold membership. ASCLS has state chapters in which clinical laboratory professionals may hold membership.
- 5. **ASCP** (American Society for Clinical Pathology) is a **professional organization** that promotes the laboratory profession and to which clinical laboratory practitioners can hold membership.

B. Certification versus Licensure

- 1. **Certification** is the process of recognizing an **individual's qualifications** by a **nongovernmental** organization or agency. It is a voluntary process that

involves meeting specific academic requirements and successfully passing an examination. Although certification is voluntary, many institutions require it for employment and/or compensation as an MT/MLT or CLS/CLT.

2. **Licensure** is the process by which a **governmental** agency (e.g., state) **grants permission to an individual** that she/he is qualified **to work** in a certain field. In the profession of clinical laboratory science, this requires meeting specific academic requirements and successful completion of an examination that may be administered by the particular state or an approved credentialing agency.

VI. INTRODUCTION TO RESEARCH METHODS

A. Research Definitions

1. **Theory:** An explanation to a problem, or how variables relate to other variables
2. **Hypothesis:** A statement regarding supposed relationships among variables, and research will support or not support the hypothesis
3. **Null hypothesis (H_0):** A hypothesis that attempts to prove no difference between two groups for the variable being investigated
4. **Statistical significance:** Used to show differences or similarities that support a theory or hypothesis
5. **Control group:** A group that is untreated or receives no special treatment
6. **Variables:** Factors influencing data or outcomes; must be accounted for in final statistical analysis

B. Types of Research

1. **Experimental-comparison design:** Comparing different groups that have been assigned to receive different treatments
2. **Single-case experimental design:** The same subjects receive different treatments, and comparisons or changes are noted.
3. **Correlational design**
 - a. The most common design that is nonexperimental
 - b. Two or more variables are measured to determine relationships.
 - c. **Example:** Is self-esteem related to grades?
4. **Descriptive research**
 - a. A type of nonexperimental quantitative research
 - b. Describes a group or set of variables as they exist without external or internal interference
 - c. **Example:** New medical technology/clinical laboratory science (MT/CLS) employees are compared with experienced MT/CLS employees.
5. Questions related to research design development
 - a. Is the problem an important one?
 - b. Does the theory regarding the problem make sense?
 - c. Does the collected data confirm the hypothesis?
 - d. Is the study feasible given the available resources?

VII. RESEARCH METHODS

A. Experimental-Comparison Design

1. Introduction
 - a. Answers questions that involve comparison of one treatment or condition with another
2. Random assignment
 - a. One of the most important features of the experimental-comparison design is the use of random assignment of subjects to various treatments.
 - 1) Random assignment solves one of the most critical problems of research design, which is selection bias.
 - 2) **Example:** The names of 100 hospital laboratories are put into a box, and 50 laboratories are chosen randomly. Personnel from 25 of the chosen laboratories are given in-service training in safety, whereas personnel from the remaining 25 laboratories are not given the safety in-service. Which laboratory's personnel will have the best safety record?
 - b. Stratified random assignment
 - 1) The process of random assignment in the **same category**
 - 2) **Example:** Random selection of private laboratories

B. Single-Case Experimental Design

1. Introduction
 - a. In single-case experiments, one or more subjects are observed over a period of time.
 - 1) The observations establish a baseline of the variables being observed.
 - 2) Once the baseline is established, a treatment is started.
 - 3) The baseline is then analyzed to determine if the treatments have made a difference to the original observations.

C. Nonexperimental Quantitative Design

1. Introduction
 - a. This type of design uses a series of observations about a subject or group of subjects in order to determine differences or similarities. No treatment is applied to the observed subjects.
 - b. **Example:** Edward Jenner in the 1700s observed dairymaids who had cowpox but did not get smallpox. He determined that people with cowpox would not get smallpox.
 - c. Quantitative research is a type of descriptive research in which the researcher is observing a subject in relation to determining differences and similarities.
 - d. Types of quantitative (descriptive) research
 - 1) Survey research
 - a) Uses questions to study a population or problem

- 2) Assessment research
 - a) Typically, uses criterion-referenced tests constructed to measure skills believed to be important
- 3) Historical research
 - a) Uses historical documents rather than people
 - b) The goal of historical research is to find connections among events in the past rather than among variables in the present.

D. Qualitative Research

- 1. Introduction
 - a. Qualitative research is intended to explore important environmental phenomena by immersing the investigator in the situation for extended periods of time.
 - b. Characteristics of qualitative research
 - 1) Uses the natural setting as the direct source of data and the researcher as the key instrument
 - 2) Descriptive
 - 3) Concerned with process rather than simply with outcomes or products
 - 4) Tends to analyze data inductively
 - 5) Meaning is of essential concern to the qualitative approach.
 - c. Types of qualitative research
 - 1) **Naturalistic observations** are those when the observer tries not to alter the situation being observed in any way but simply records whatever is seen.
 - 2) **Open-ended interviews** attempt to let the person being interviewed tell their story in detail without interference by the interviewer.
 - 3) Data used in qualitative research include:
 - a) Field notes
 - b) Documents and photographs
 - c) Statistics

VIII. MEASURES AND SAMPLING

A. Concepts of Critical Importance

- 1. **Reliability** refers to the degree to which a measure is consistent in producing the same readings when measuring the same things.
 - a. In the case of questionnaires, tests, and observations, the goal is to create measures that will consistently show differences between groups that occur in all situations where those measures are used.
- 2. **Validity** refers to the degree to which a measure actually measures the concept it is supposed to measure.
 - a. Types of validity
 - 1) **Content validity:** The degree to which the content of a test matches some objective criterion

- 2) **Predictive validity:** The degree to which scores on a scale or test predict later scores
- 3) **Concurrent validity:** The correlation between scores on a scale and scores on another scale that has been established to be valid
- 4) **Construct validity:** The degree to which scores on a scale have a pattern of correlations with other scores or attributes that would be predicted to exist

B. Types of Measures

1. **Questionnaires** can be developed to assess personality, attitudes, and other noncognitive variables.
 - a. Characteristics involved in constructing questionnaire:
 - 1) Questions should be as short and clear as possible.
 - 2) Double negative questions should be avoided.
 - 3) Cover all possibilities if multiple choice questions are used.
 - 4) Include points of reference or comparison when possible.
 - 5) Emphasize words that are critical to the meaning of the questions.
 - 6) Ask only important questions.
2. **Interviews** are used to ask individuals specific questions; however, interview data are more difficult to collect and analyze.
 - a. Constructing an interview protocol
 - 1) Develop questions.
 - 2) Develop notes that will indicate a course of action in response to certain answers.
 - 3) Be prepared for clarification of questions and responses.
 - 4) Have a plan to analyze the collected data.

C. Sampling

1. Introduction to sampling
 - a. Sampling is very important in research design; it is designed to assess part of the larger group.
 - b. Each member of the population from which the sample is drawn should have an equal and known probability of being selected.
 - c. The larger the sample size, the smaller the sampling error.
2. Types of samples
 - a. **Cluster samples** include sampling groups rather than individuals.
 - b. **Stratified random samples** include random assignment of subjects to one or more groups that will ensure that each group has certain characteristics.
 - c. **Samples of convenience** include sampling a small group and making the argument that these findings will apply to the larger group.
3. Sample size
 - a. A critical element of research design

- b. If the sample is too small, chances are good that no statistically significant results will be obtained.
- c. The sample size depends on the amount of error accepted, the number of variables being tested, and the type of statistical analysis to be used (Student's *t*-test, chi-square test, ANOVA, etc.). There are statistical programs that can be used to establish the minimal number of samples needed to obtain statistically useful data.
- d. Generally, the larger the sample size, the better chance there will be to observe statistical significance.

IX. PLANNING THE STUDY

A. Criteria for a Research Topic

- 1. Of interest to you and others
- 2. Important
- 3. Build on previous research.
- 4. Timely
- 5. Resources (time, money, research tools) available to adequately study the topic.

B. Gather Information

- 1. Start with a widely focused literature search: Internet searches are a good way to start, along with abstracts, journals, and books.

C. Steps in the Proposal (What You Want to Do and How You Will Do It)

- 1. **Statement of the problem:** Briefly introduces the questions to be answered and discusses the importance of the problem
- 2. **Hypothesis:** A statement that summarizes what one expects to find or learn
- 3. **Literature review:** A summary of the research relevant to the topic
- 4. **Procedures** should include the following:
 - a. Subjects and sampling plan
 - b. Procedures
 - c. Measures
 - d. Analysis of the collected data
- 5. **Time frame** for study completion

X. INTRODUCTION TO STATISTICAL TERMS

A. Scales of Measurement

- 1. **Nominal scale:** Uses numbers as names for certain categories or groups. Nominal scale numbers have no relationship to one another.
- 2. **Ordinal scale:** Ordinal scale numbers are in a definite order, but without regard to distance among numbers.
- 3. **Interval scale:** Scores or numbers differ from one another by the same amount, without regard to a zero point.
- 4. **Ratio scale** is an interval scale with a true zero point.

B. Measures of Central Tendency

1. **Mean:** Average of a set of numbers
2. **Median:** The middle number of a set
3. **Mode:** The most frequent number

C. Measures of Dispersion

1. **Standard deviation (SD)** is the dispersion or scatter of a set of numbers. SD is the square root of the variance.
2. **Variance** is the degree of dispersion or scatter of a set of numbers. The variance is the square of the standard deviation.

D. Statistical Comparisons

1. **Statistical significance:** Two or more statistics are found to be more different than would be expected by random variation
2. **Student's *t*-test:** Statistics used to determine if means from two different samples are different beyond what would be expected due to sample to sample variation
3. **Student's *t*-test for comparison of two means from matched groups:** Used to compare the same subjects under two different conditions or at two different times
4. **Analysis of variance (ANOVA):** Used to compare more than two samples
5. **Analysis of covariance (ANCOVA):** Used to compare two or more group means after **adjustment** for a control variable
6. **Chi-square test:** Uses frequency count data, such as the number of individuals falling into a particular category

XI. WRITING A JOURNAL ARTICLE

A. Format and Style of Journal Articles

1. **Abstract:** Brief synopsis (about 150 words) that summarizes the purpose, methods, and study results
2. **Introduction:** Brief review of the literature supporting the topic, describing the purpose and significance of the study
3. **Methods:** Description of the procedures and methods used in the study
4. **Results:** Description of the findings of the study
5. **Discussion:** Analysis of results and correlation to support the theory and literature discussed in the introduction
6. **Summary:** One or two paragraphs capturing key results
7. **References:** Citations of other people's work used in the body of the article; substantiates theory and results

B. Tips for Getting Published

1. Have several people read your manuscript for accuracy, content, etc.
2. Follow the format, style, and other journal requirements very carefully.
3. If your article is rejected, make editorial adjustments and resubmit.
4. Send rejected articles to another journal for possible publication.



review questions

INSTRUCTIONS Each of the questions or incomplete statements that follows is comprised of four suggested responses. Select the *best* answer or completion statement in each case.

1. The three levels of test questions are
 - A. Recall, synthesis, interpretation
 - B. Recall, interpretation, problem solving
 - C. Recall, synthesis, problem solving
 - D. Easy, interpretation, case studies
2. The statement, "The curriculum is designed to prepare graduates to develop procedures for the analysis of biological specimens," is an example of a(n)
 - A. Course description
 - B. Goal
 - C. Task analysis
 - D. Objective
3. The statement, "Given a hemacytometer, the student will perform manual red cell counts with 90% accuracy," is an example of a(n)
 - A. Course description
 - B. Goal
 - C. Task analysis
 - D. Objective
4. Which of the following represents an action verb?
 - A. Understand
 - B. Diagram
 - C. Know
 - D. Realize
5. Of the major domains for behavioral objectives, which domain contains objectives involving values and attitudes?
 - A. Affective
 - B. Analytical
 - C. Cognitive
 - D. Psychomotor
6. Which of the taxonomic levels in the cognitive domain is represented by the following objective?
Objective: Given the glucose control values for a month, the student will calculate the mean and standard deviation.
 - A. Knowledge
 - B. Comprehension
 - C. Application
 - D. Analysis

7. What part of the following statement represents the conditions of the objective?
Objective: Given the appropriate tools and written procedure, the student will perform daily maintenance on the chemistry analyzer without error.
 - A. Given the appropriate tools and written procedure
 - B. The student will perform daily maintenance on the chemistry analyzer
 - C. The student will
 - D. Without error
8. A name tag reads: "Jane Smith, MT(ASCP), CLS(NCA)." What does this tell us about Jane Smith's professional credentials? She is
 - A. Accredited
 - B. Certified
 - C. Licensed
 - D. Registered
9. Which of the following terms refers to the process by which an agency evaluates a medical technology program and recognizes that it has met certain preset standards?
 - A. Accreditation
 - B. Certification
 - C. Licensure
 - D. Registration
10. An instructor observes a medical technology student cheating on an examination. What is the best action to take?
 - A. Ignore the behavior because the student is hurting only himself/herself.
 - B. Stop the examination and collect all the papers.
 - C. Document the incident, but do not report it unless it is repeated.
 - D. Document the incident and report it to the appropriate authority.
11. Which of the following activities is *not* associated with problem-based learning (PBL)?
 - A. The learner determines what information needs to be learned.
 - B. The instructor serves as a facilitator.
 - C. The learner identifies the appropriate educational resources.
 - D. The instructor presents a lecture series for each instructional unit.
12. Which of the following is an advantage of the lecture method?
 - A. Useful for teaching technical skills
 - B. Student is an active participant
 - C. Pace is controlled by the learner
 - D. Disseminates large amounts of information
13. What is one of the most common problems encountered with use of overhead transparencies?
 - A. Classroom kept dark when they are used
 - B. Contain too much information
 - C. Take long time to prepare
 - D. Difficult to design
14. Why are computer-projected visual aids a benefit to the instructor?
 - A. Classroom is not dark or dim when they are used
 - B. Do not require special projection equipment
 - C. Motion, color, and sound can be incorporated
 - D. Inexpensive to produce
15. Role-playing is designed to strengthen skills in which educational domain?
 - A. Affective
 - B. Psychomotor
 - C. Aesthetic
 - D. Cognitive

16. Which of the following is *not* considered a right that students have in the learning environment?
 - A. The right to ask questions of the instructor
 - B. The right to fair and objective assessment
 - C. The right to not attend classes at his/her own discretion without penalty
 - D. The right to request additional help when needed
17. Which of the following testing types assesses a student's performance on an examination independent of peer performance?
 - A. Norm referenced
 - B. Objective referenced
 - C. Criterion referenced
 - D. Standard referenced
18. The ASCP Board of Registry certification examination is an example of which of the following types of tests?
 - A. Placement
 - B. Formative
 - C. Summative
 - D. Diagnostic
19. Which of the following refers to the contract between an academic institution and a clinical education site that describes the responsibilities of the institutions and the expectations of students?
 - A. Accreditation agreement
 - B. Affiliation agreement
 - C. Education contract
 - D. Clinical policy statement
20. The evaluation tool that monitors the performance of each step comprising a technical procedure is called a
 - A. Checklist
 - B. Rating scale
 - C. List of objectives
 - D. Practical exam
21. Which of the following is *not* a type of research design?
 - A. Nondescriptive design
 - B. Experimental-comparison design
 - C. Descriptive research
 - D. Correlational design
22. Stratified random assignment is
 - A. Nonrandom assignment in a different category
 - B. Nonrandom assignment in the same category
 - C. Random assignment in a different category
 - D. Random assignment in the same category
23. Quantitative research is a type of descriptive research where the researcher observes a subject
 - A. For bad habits
 - B. For characteristic traits
 - C. To determine differences
 - D. In relation to determining differences and similarities
24. Which of the following refer to the degree to which a measure is consistent in producing the same reading when measuring the same things?
 - A. Concurrent reliability
 - B. Construct validity
 - C. Reliability
 - D. Validity
25. The larger the sample size, the smaller the
 - A. Population bias
 - B. Sampling error
 - C. Reliability error
 - D. Random sample
26. Standard deviation is
 - A. Used for frequency count data
 - B. The dispersion of a set of numbers
 - C. Used to compare more than two samples
 - D. The statistics used to determine if means are from two different populations



answers & rationales

1.

B. The three levels of test questions are recall of the knowledge imparted by the teacher, interpretation or the ability to apply that knowledge to data presented, and problem solving, in which the student selects the appropriate path to resolve a problem. Problem solving is the most complex level of the three. Synthesis refers to a student's ability to take parts and create a new "whole." Case studies are typically used in problem-based learning.

2.

B. Goals describe what a learner will be able to do and are written in general terms and do not describe behaviors. An objective is a statement that describes what a learner will be able to do at the end of a unit of instruction. A task analysis is a description of the knowledge and skills needed for competence in the work setting. Course descriptions differ from objectives in that the former do not describe what the learner is expected to achieve but give information about course content.

3.

D. An objective is a statement that describes what a learner will be able to do at the end of a unit of instruction. Goals also describe what the learner will be able to do; however, they are written in general terms and do not describe behaviors. A task analysis is a description of the knowledge and skills needed for competence in the work setting. Course descriptions differ from objectives in that the former do not describe what the learner is expected to achieve but give information about course content.

4.

B. Action verbs describe an activity that is observable and measurable. Using action verbs in writing objectives clearly conveys the instructor's expectations of students. Verbs that are more general, such as "understand," "know," and "realize" do not describe performances that are measurable; they may be used for goals.

5.

A. Objectives have been classified into three major domains: cognitive, affective, and psychomotor. The cognitive domain includes those objectives that emphasize the intellect. Cognitive behavior includes the recall of information, the comprehension of that information, and the processes of application, analysis, synthesis, and evaluation. The affective domain includes those objectives that emphasize values and attitudes, such as the importance of maintaining patient confidentiality and the desire to follow laboratory safety procedures. The psychomotor domain deals with those behavior outcomes that require neuromuscular function, such as the actual performance of a laboratory procedure.

6.

C. At the application level, the student is taking previously learned material and using it to resolve a problem such as a calculation. Knowledge is the lowest level of cognitive learning and involves simply recalling learned material. At the comprehension level, the student grasps the meaning of the material but does not see the fullest implication of that material. Analysis represents higher levels of learning in which the student understands the organization of the material and can reorganize the component parts so that they form a new pattern or structure.

7.

A. The conditions in an objective (“Given the appropriate tools and written procedure”) describe what will be provided or denied to the student in order to accomplish the objective. Other parts of an objective include the terminal behavior required by the learner (“the student will perform daily maintenance on the chemistry analyzer”) and the standards of performance (“without error”). The terminal behavior addresses what the learner must be able to do after completing the instructional unit. The standards of performance

indicate how well the learner must perform for an acceptable behavior.

8.

B. The initials MT(ASCP), CLS(NCA) indicate that Jane Smith is certified by the American Society for Clinical Pathology as a medical technologist and by the National Credentialing Agency for Laboratory Personnel, Inc., as a clinical laboratory scientist. Certification is the process by which an individual’s qualifications are recognized by a nongovernmental organization or agency. It is a voluntary process and usually involves meeting specific academic requirements and passing an examination.

9.

A. The National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) is responsible for the evaluation and recommendation of accreditation of medical technology programs after self-study and the site visit. The term “certification” refers to the process by which an individual’s competency is recognized by a nongovernmental agency or association. Licensure is the process by which a governmental agency grants an individual the permission to work in a certain field after successful completion of an examination. The term “registration” refers to the process by which individuals are identified by a nongovernmental agency as being certified. The term “registration” has been replaced by “certification.”

10.

D. An instructor should be familiar with the institution’s procedure for handling cheating and should follow established guidelines when cheating is detected. Ignoring the problem or assigning a failing grade does not help the student. Ignoring the problem will also damage the morale of the other students, who are often aware when an individual is cheating.

11.

D. Problem-based learning (PBL) is designed for the instructor to serve as a facilitator in the learning process. The goal for students is to resolve problems, develop critical thinking skills, and learn team communication skills. The students determine what information is needed to solve the problems posed and select the appropriate resources. Traditional lecturing is not a characteristic component of PBL.

12.

D. The lecture format is good for disseminating large amounts of information to the learner. It is the most popular learning format and is useful for bringing together information from a variety of sources. It can be limiting, however, because of the lack of involvement of the learner.

13.

B. Overhead transparencies represent a very useful and versatile audiovisual teaching aid. They are easy to prepare and can be used in a lighted room while the instructor faces the audience. A common problem with overhead transparencies is that they contain too much information. Overhead transparencies should be designed with brief, concise highpoints and simple graphics.

14.

C. The addition of motion, color, and sound to visual media facilitates the learning process by stimulating interest, and they are attention grabbing. Grab a student's interest and attention, and the motivation to learn will follow. Classrooms are typically darkened to some degree when computer-projected visual aids are used. They require special projection equipment and that equipment is usually costly.

15.

A. Role-playing represents a learning format that is specifically designed to promote cooperative problem solving and communication skills. For these reasons, role-playing is useful for developing learning outcomes in the affective domain. Role-playing is especially effective when it represents a situation that the student will be likely to encounter in the future.

16.

C. Students have a *responsibility* to attend classes, and instructors can institute academic penalty(ies) for missed classes provided details are stated clearly in the course syllabus. Students have the right to ask questions, to fair assessment, and to extra help, as well as the right to a good, quality education and respect from the instructor. Likewise, students should conduct themselves in a respectful manner in the learning environment.

17.

C. Criterion-referenced examinations assess a student's mastery of a skill or body of knowledge with the use of predetermined minimal standards. Unlike a traditional norm-referenced test, in which students compete with one another on test performance, it is possible and even desirable for all students to do well on a criterion-referenced test. Examples of criterion-referenced examinations are the certification examinations of the ASCP Board of Registry (American Society for Clinical Pathology) and the National Credentialing Agency for Laboratory Personnel, Inc. (NCA).

18.

C. The certification examination of the ASCP Board of Registry is an example of a summative test, because it is comprehensive and designed to assess the mastery of a body of material. Placement tests are designed to test for prerequisite skills necessary for a course of study. Formative tests are administered during a course of study and allow the student to assess his knowledge at that time. Diagnostic tests are administered to aid in defining learning disabilities.

19.

B. The National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) through the *Standards of Accredited Educational Programs* requires affiliation agreements between academic institutions and clinical education sites. The affiliation agreement describes the responsibilities between the two institutions. Its purpose is to ensure a quality learning experience for the students.

20.

A. A checklist is a list of statements describing expected student behaviors in performing the steps that comprise a particular task or procedure. The behaviors are checked to indicate whether or not they occurred. A checklist is differentiated from a rating scale by its “all or none” format.

21.

A. Experimental-comparison design compares different groups that have been assigned to receive different treatments or studies of before and after treatment. With correlational studies, two or more variables are measured to determine relationships. Descriptive research is a type of nonexperimental quantitative research. Nondescriptive design is not a type of research design.

22.

D. Stratified random assignment is the process of random assignment in the same category. Random assignment of individuals to groups helps overcome sampling errors or bias. Selection bias is one of the most critical problems of research design.

23.

D. Quantitative research is a type of descriptive research where the researcher is observing a subject in relation to determining differences and similarities. Survey research where questions are used to study a population or problem is an example of quantitative research. Historical and assessment research are other examples.

24.

C. Reliability is the degree to which a measure is consistent in producing the same readings when measuring the same things. Validity is the degree to which a measure actually measures the concept it is suppose to measure. Worthwhile research data must have reliable and valid measurement tools.

25.

B. The larger the sample size, the smaller the sampling error. Sample size is an important part of research design. If the sample is too small, chances are good that no statistically significant results will be obtained. However, as the sample size increases, the cost of performing the study increases.

26.

B. The standard deviation (s or SD) is the dispersion or scatter of a set of numbers. Standard deviation is the square root of the variance. Along with the mean, a measure of central tendency, the standard deviation is a descriptive statistic used to summarize data in a sample.

REFERENCES

- Beck, S. J., and LeGrys, V. L. (2007). *Clinical Laboratory Education* (CD ROM). Bethesda, MD: The American Society for Clinical Laboratory Science.
- Harmening, D. M. (2007). *Laboratory Management Principles and Processes*, 2nd ed. St. Petersburg: D. H. Publishing & Consulting.
- McKeachie, W. J., and Svinicki, M. D. (2006). *McKeachie's Teaching Tips: Strategies, Research, and Theory for College and University Teachers*, 12th ed. Boston: Houghton Mifflin Company.
- Riegelman, R. K. (2000). *Studying a Study and Testing a Test*, 4th ed. Philadelphia: Lippincott Williams & Wilkins.
- Weissman, J. (2003). *Presenting to Win: The Art of Telling Your Story*. Upper Saddle River, NJ: Financial Times Press Pearson Education.

